Partial Retirement Opportunities and the Labor Supply of Older Individuals*

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Abstract

We evaluate partial retirement options as a tool to increase labor participation among older individuals. In a stated choice experiment, Dutch survey respondents were asked to choose among early, late and partial retirement scenarios purged from restrictions on part-time and gradual retirement. Retirement scenario characteristics were randomized, generating rich variation in the choice options. The stated choices are validated using revealed preference data on (planned) retirement decisions. Using the stated choice data, we estimate a model that makes the trade-offs between leisure and income over the life cycle explicit, and use the estimated model for counterfactual policy simulations. We find that, as expected, a higher statutory retirement age makes actuarially fair (abrupt) early retirement more attractive and makes late retirement less attractive, while for any statutory retirement age, about one in three respondents prefer partial retirement. The partial retirement decision is sensitive to pension accruals and the wage rate during partial retirement. At the extensive margin, retirement decisions are more sensitive to accrual and wealth effects of pensions than found in earlier studies. Early retirement becomes more attractive than late retirement when individuals do not have the partial retirement option, demonstrating the potential of partial retirement as a policy instrument to stimulate labor participation, especially when the statutory retirement age is increased.

1 Introduction

The most common retirement scenario is an abrupt transition from a full-time job into full retirement, also referred to as abrupt or cliff-edge retirement (Vickerstaff et al., 2003), at the

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statutory (or normal) retirement age. Existing studies show that mandatory retirement and program incentives in public and private pension schemes induce individuals to retire at this age (Stock and Wise, 1990; Blau, 1994; Rust and Phelan, 1997; Coile and Gruber, 2007; Atav et al., 2023). Moreover, restrictions imposed by employers often limit the workers' opportunities to reduce their number of work hours in a gradual manner before withdrawing completely from the labor market, e.g. due to fixed costs per worker, difficulties to organize part-time work schedules, or a negative attitude towards older workers preventing employers from making special arrangements (Hutchens, 2010; Rogerson and Wallenius, 2013). In other words, institutional regulations and restrictions limit older workers' opportunities for alternative retirement trajectories that would allow an optimal combination of work, leisure, income and consumption over the life cycle. This also limits the scope of policy reforms aimed at financial incentives to increase labor market participation among older age groups.

In a partial retirement scenario, as an alternative to cliff-edge retirement, employees gradually reduce their work hours or change to a less demanding job with usually lower earnings before they completely leave the labor market. Partial retirement has gained importance over time as an alternative to abrupt retirement or flexibility in work hours through a switch to self-employment (Bloemen et al., 2016; Parker and Rougier, 2007). Partial retirement programs have several potential advantages. First, they allow employees to gradually adjust and smooth leisure and consumption over the life cycle in line with the predictions of standard labor supply models (Ameriks et al., 2020). Those who would like to work less can combine part-time earnings with a partial pension, especially since early claiming of a full pension can reduce the pension substantially (Kantarcı et al., 2013) and similarly, partially disabled employees can combine part-time work and part-time earnings with a partial disability benefit (Pagán, 2009). Second, partial retirement allows employers to retain people with precious skills that are difficult to replace (Hutchens, 2010). Third, partial retirement may extend employment years by facilitating work after the statutory retirement age or by restraining early withdrawal from the labor market, for example for employees with demanding occupations (Vermeer et al., 2016). This implies extending pension contribution periods and reducing years of claiming full benefits, which helps to sustain the pension system. This also seems to be the main reason why many countries consider ways to remove impediments to partial retirement, as part of a package of policy measures to increase retirement flexibility.

Many employees state an interest in working part-time before retirement. In a US Internet survey in 2015, about 60% of nonworking respondents would be willing to return to work if they could choose the number of hours worked instead of having to work the same number of hours as in their last job. Furthermore, 20% of them are willing to accept a more than 20% hourly wage reduction to do so (Ameriks et al., 2020). Figure 1 analyzes Dutch individuals in paid employment who are asked to state whether they want to work more hours, fewer hours, or the same number of hours they work now in the Labor Force Survey conducted by Statistics Netherlands. We distinguish four age categories and analyze responses over a period of 15 years. We present the fraction of respondents who want to work fewer hours. The fraction is very stable over the observation period for all age groups except that the oldest age group shows a notable increase from the year 2013 when the state pension eligibility age started to increase for cohorts born after 1948. The figure suggests that individuals want to work fewer hours as their state pension eligibility age is delayed beyond age 65.

The economics literature explains the labor supply behavior of older workers in a life cycle framework, where workers choose the optimal combination of work, leisure, income and consumption, taking account of the future by maximizing expected utility over the life cycle (Lazear, 1987; Hurd, 1990; Lumsdaine and Mitchell, 1999; Rogerson and Wallenius, 2013). Models explaining retirement decisions are usually estimated using data on actual retirement (Stock

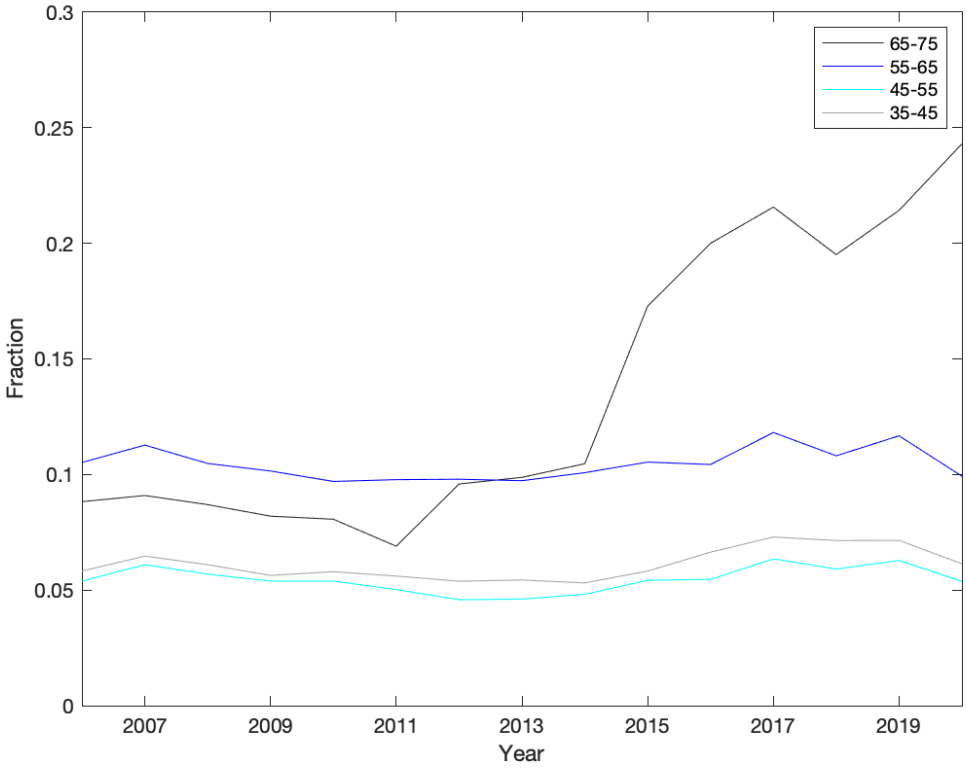


Figure 1: Fraction of employees who want to work fewer hours in employees who want to work more hours, fewer hours or continue to work the same number of hours by age and year.

and Wise, 1990; Rust and Phelan, 1997; French, 2005; Van der Klaauw and Wolpin, 2008). From such data, however, it is often difficult to identify an individual's available retirement options in detail. This particularly applies to partial retirement plans, since it is often unclear whether an employer offers such a plan, and, if so, which trajectory of earnings and pension incomes it implies. Indeed, partial retirement arrangements are often informal agreements negotiated between employer and employee (Hutchens, 2010). A comparison of survey data on actual and preferred working hours shows that older workers often want to work part-time, but actually work full-time or not at all, suggesting that data on actual work hours substantially underestimate preferences for partial retirement (Ameriks et al., 2020).

To analyze preferences for partial and full retirement purged from restrictions on part-time work or gradual retirement, we draw on stated choice data. As argued by Louviere et al. (2000), such data can capture a wider and broader array of preference-driven behaviors than data on actual behavior, allowing for choice opportunities that do not yet exist in the market. This also applies to our study: we analyze retirement plans that do not yet exist or are not available to many workers. We present our survey respondents with a choice set of hypothetical full and partial retirement plans, irrespective of whether the respondent's own employer actually offers partial retirement or not. Each retirement plan has its own income trajectory. The labor market states considered are working full-time, working part-time with a partial pension, and full retirement; alternative exit routes such as unemployment or disability do not play a role. To choose their favorite plan, respondents trade-off between working more hours or more years with a higher pension level versus working less with a lower pension. Respondents

are randomly assigned to different amounts of pension income and ages of retirement in the hypothetical retirement plans. We vary pension income levels, either changing rewards for later retirement (the accruals), or changing the overall generosity irrespective of the retirement age (the pension wealth). We also vary the wage rate during partial retirement and duration of partial retirement. We then estimate a structural model to analyze individuals' decisions to work full-time or (gradually) retire and conduct several policy simulations, e.g. aimed at stimulating partial retirement.

We add to the literature in several respects. First, Van Soest and Vonkova (2014) and Elsayed et al. (2018) conduct stated choice experiments to analyze the impact of pension incentives on retirement decisions, including partial retirement. Van Soest and Vonkova estimate a structural model on nationally representative data, while Elsayed et al. conduct reduced-form analysis among public sector employees. Like Van Soest and Vonkova, we estimate a structural model on nationally representative data. We use more recent data and explore much richer aspects of partial retirement. More importantly, we designed the stated choice experiment accounting for the actuarial rules of the Dutch pension system. Making the survey realistic is important because surveys are not only a way of collecting data, but they involve creating the process that generates the data (Stantcheva, 2023). The more realistic is the hypothetical market setting, the more likely that stated choice behaviour look like real choice behaviour (McFadden, 1998).

Second, as the value of the stated choice data depends on whether they are predictive of real behavior, we validate the stated choices using revealed preference data. We validate that the estimated preferences of labor supply correlate in plausible ways with, among others, peoples' actual or predicted retirement plans and with a subjective question on whether they value work just for money or for its intrinsic value.

Third, we contribute to the literature analyzing the sensitivity of retirement decisions to financial incentives. Earlier studies typically consider the retirement decision as a binary outcome, mostly able to analyze the wealth effects of pensions, or analyze sensitivity of the retirement decision only at the public pension eligibility age (Van der Klaauw and Wolpin, 2008; Danzer, 2013; Atalay and Barrett, 2015; Delavande and Rohwedder, 2017). We disentangle wealth and price effects of pensions, both at the intensive and extensive margins, at various retirement ages. We show that, at any retirement age, the partial retirement decision is not sensitive to a wealth but a price effect of pensions. Responses at the extensive margin are sensitive to both wealth and price effects of pensions. In our choice experiment, random changes in pension levels from benchmark levels are used to estimate the effects of pension incentives. The magnitude of the changes in pension incentives are made much smaller than those considered in earlier studies so that they are much more within the reach of policy makers who have to carefully consider pension interventions. Furthermore, we show that a reduction in hourly wage rate in partial retirement makes partial retirement less attractive and both early and late retirement equally more attractive.

Fourth, in the Dutch occupational pension system, participants have maximum retirement flexibility with actuarially fair trade-offs: Employees can choose, but pay a fair price for retiring early and are rewarded for working longer. They can also retire part-time and claim part of their accrued pension rights and delay claiming of the remaining part. We consider institutionally possible forms of partial retirement, and document preferences for them against, e.g., the classical alternative of abrupt retirement at the public pension eligibility age. At any given age from 60 to 66, more than one in three prefer partial retirement over full retirement or to continue to work full-time for a number of years. This provides strong evidence of a preference for a smooth life-cycle profile of leisure and consumption and hence a low intertemporal elasticity of substitution for many individuals (Ameriks et al., 2020), and points to labor market restrictions

to explain abrupt retirement that is often observed in revealed preference data (Rogerson and Wallenius, 2013). Those who prefer partial retirement more often prefer to spend 20 hours a week in partial retirement instead of less or more hours, they are equally likely to spend 4 or 5 years in partial retirement, and they are equally likely to reduce hours in one step or in a more gradual manner in two steps. These preferences change as retirement age is delayed.

Fifth, partial retirement schemes can stimulate labor participation if older individuals more often use them to substitute full retirement than full-time work. We show that early retirement becomes more attractive than late retirement when individuals do not have the partial retirement option, especially when the statutory retirement age increases. This demonstrates the potential of partial retirement as a policy instrument to stimulate older individuals to remain active in the labor force. This is in line with Ameriks et al. (2020) who find in the US that older individuals would work longer if they had opportunities to work in jobs that allow them to choose the number of hours worked per week or the number of weeks worked per year.

Finally, we evaluate subsidized partial retirement programs that were introduced in Dutch collective labor agreements of a number of sectors in the last ten years. We compare choices for partial retirement, against early and late retirement, when wage compensation and pension accrual during partial retirement are subsidized according to collective labor agreements and when they are based on existing offers from pension funds that involve no subsidy. We show that subsidies make partial retirement attractive but to a lesser extent when retirement age is delayed. Moreover, subsidies induce individuals who otherwise would have stopped working or continued to work full-time to participate in partial retirement, making its net effect on labor supply ambiguous.

This paper proceeds as follows. Section 2 describes the Dutch pension system. Section 3 describes the stated choice experiment. Section 4 describes the data and presents descriptive statistics. Section 5 presents the model and the estimation method. Section 6 presents the estimation results and section 7 conducts policy simulations. Section 8 concludes.

2 The Dutch pension system

Retirement income in the Netherlands mainly stands on two main pillars: the state pension and the occupational pension.[1] The General Old-Age Pensions Act (AOW) is the state pension scheme, paying a flat-rate benefit when people reach the state pension age, independent of earnings, income or premiums paid. The benefit level depends on the number of years of residence in the country and on household composition. For those who always resided in the country, it provides households older than the statutory retirement age with a subsistence-level income. The scheme is unfunded and based on the pay-as-you-go principle: current state pensions are financed from the current premiums paid by workers. The premiums are paid through income tax. The statutory retirement age is gradually being delayed from age 65 in 2013 to age 67 in 2025 and will be delayed further if life expectancy increases. It does not allow flexible claiming of pension rights.

Participation in the occupational pension scheme is mandatory for almost all employees. It is fully funded so that the pensions are financed from the premiums of the participants paid in the past and from the returns on the invested premiums. The scheme is an individual scheme in principle, but for employees with a partner, it incorporates a widow's pension (and orphans pension for children up to some age threshold). Today many occupational pension funds allow maximum retirement flexibility with actuarially fair trade-offs: Employees can choose, but pay a fair price for retiring early and are rewarded for working longer. They can also retire part-time

[1]The third pillar is private pension savings and its share in retirement income is much smaller.

and claim part of their accrued pension rights and delay claiming of the remaining part. As an add-on to these schemes, subsidized partial retirement schemes were introduced in collective labor agreements in the last decade, allowing employees to work fewer hours in the years before reaching their statutory retirement age with a less than proportional decrease in salary and a pension accrual based on full-time salary ("'Generatiepact", "Regeling Partiële Uittreding", "Vitaliteitspact"; see, e.g., Rutten et al. (2022)).

3 The stated choice experiment

The survey consisted of two main parts. The first part included questions on background characteristics and several aspects of work and social life. The second part aimed at measuring preferences for abrupt and partial retirement. Prior to the second part, an instructions page is presented where the layout of the retirement scenarios is described in detail. Several stated choice questions are considered, each asking the respondent to make a trade-off between working more with a higher pension versus working less with a lower pension. Figure 2 shows an example stated choice question. It starts with an introductory explanation and then describes three retirement scenarios with a short text followed by a time line giving the number of hours worked and the earnings and pension income at each age. Respondents are asked to choose their favorite retirement scenario among the three.

Each retirement scenario takes the form of a vignette: a short description of a hypothetical situation. Vignettes have been used for a long time in the social sciences and more recently also in economics, see, e.g., Van Beek et al. (1997) for an early example. Our vignettes describe hypothetical people. The main reason for this is that respondents for whom the retirement scenarios seem unrealistic can still answer the questions. For example, unemployed or disabled workers are often reluctant to respond if asked to imagine they have a permanent job until retirement age, but will take it less personal if asked to evaluate a hypothetical person's retirement plan from the point of view of their own preferences.

Each retirement scenario is characterized by four attributes: age of retirement, number of hours worked, work income, and pension income. The age at which the employee retires is completely independent of the respondent's own employment situation, age, or other characteristics.

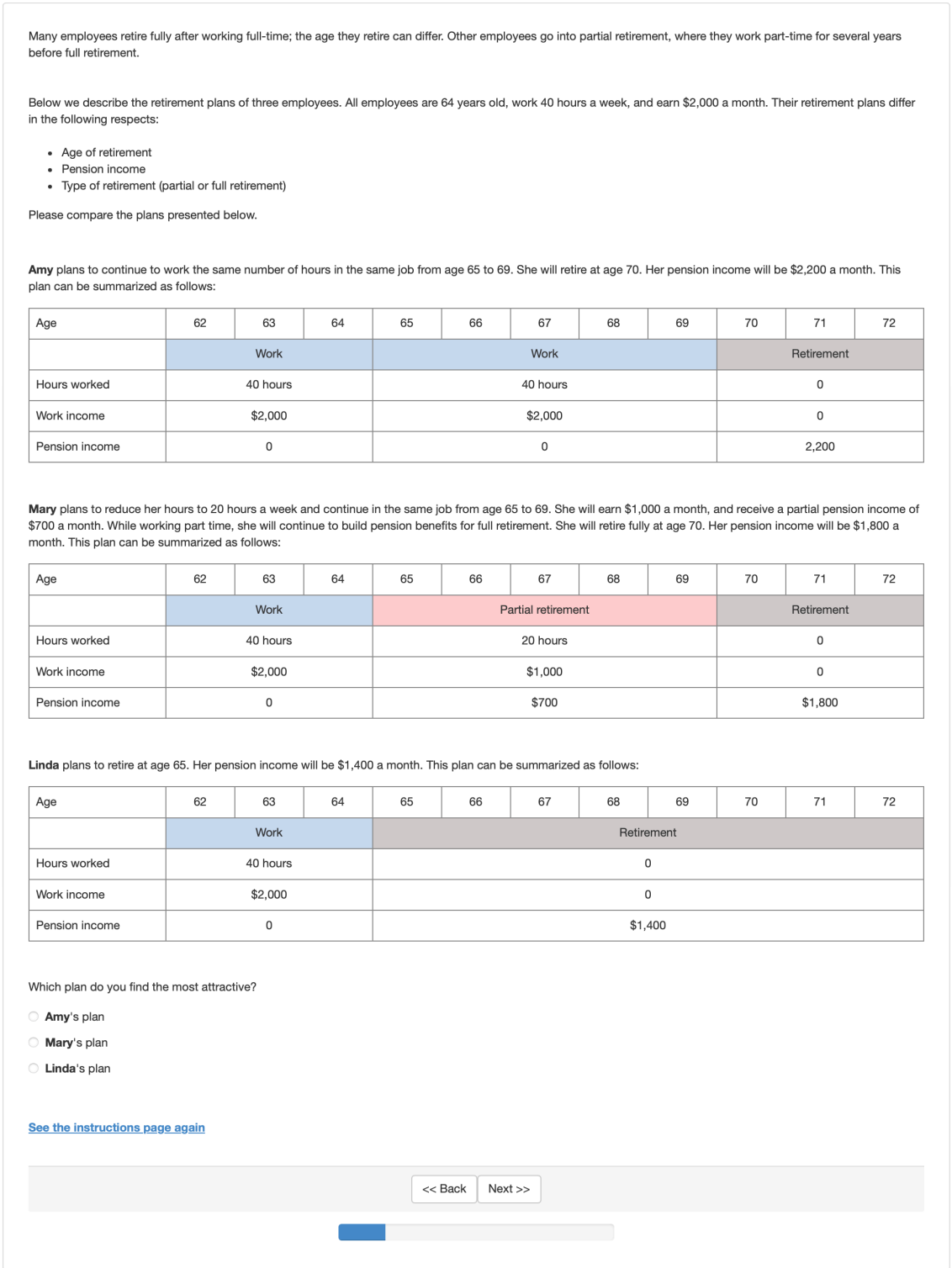
The hypothetical employee works 40 hours a week during full-time work and 20 hours a week during partial retirement.[2] Work income is based upon the respondent's actual earnings in the current or last job.[3] which is asked in an earlier categorical question on last earnings. Pension income is computed as a percentage of work income, starting from a given (net) replacement rate. Pension and work income are both shown in absolute amounts; the replacement rates are not shown.

The replacement rates are based upon actual replacement rates in full and partial retirement at various ages in the Netherlands, as computed by Kantarcı et al. (2013) for a worker earning the average wage with an uninterrupted service length of 40 years in the case of retirement at age 65. We scaled down the replacement rates, since with career gaps and jobs that do not have automatic pension savings, 40 years of occupational pension contributions is unrealistic. For example, in the case of abrupt retirement at age 65, the net replacement rate we use is 70%.

We asked respondents to evaluate three scenarios, as described above, in three similar questions, changing the retirement ages in these questions. That is, each question considers a

[2] In the Netherlands, in 2014 the average full-time worker worked about 41 hours a week and the average part-time worker worked about 23 hours a week (own calculations using data from DNB Household Survey, ages 40 plus).

[3] This is done to avoid the alienation bias that might arise if respondents have problems evaluating choices that are too far from their own situation (Hanemann, 1994; Whittington, 2002).



Many employees retire fully after working full-time; the age they retire can differ. Other employees go into partial retirement, where they work part-time for several years before full retirement.

Below we describe the retirement plans of three employees. All employees are 64 years old, work 40 hours a week, and earn $2,000 a month. Their retirement plans differ in the following respects:

- Age of retirement
- Pension income
- Type of retirement (partial or full retirement)

Please compare the plans presented below.

Amy plans to continue to work the same number of hours in the same job from age 65 to 69. She will retire at age 70. Her pension income will be $2,200 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Work					Retirement		
Hours worked	40 hours			40 hours					0		
Work income	$2,000			$2,000					0		
Pension income	0			0					2,200		

Mary plans to reduce her hours to 20 hours a week and continue in the same job from age 65 to 69. She will earn $1,000 a month, and receive a partial pension income of $700 a month. While working part time, she will continue to build pension benefits for full retirement. She will retire fully at age 70. Her pension income will be $1,800 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Partial retirement					Retirement		
Hours worked	40 hours			20 hours					0		
Work income	$2,000			$1,000					0		
Pension income	0			$700					$1,800		

Linda plans to retire at age 65. Her pension income will be $1,400 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Retirement							
Hours worked	40 hours			0							
Work income	$2,000			0							
Pension income	0			$1,400							

Which plan do you find the most attractive?

- **Amy**'s plan
- **Mary**'s plan
- **Linda**'s plan

See the instructions page again

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Figure 2: The stated preference question asking to choose among early, partial and late retirement.

particular retirement age regime, denoted as 65, 63, and 61. A regime defines particular ages of full and partial retirement in the three retirement scenarios that a respondent is asked to compare in the three questions; see Table 1. For example, in the question associated with regime 65, the retirement age in the first (abrupt) retirement scenario is 65, in the second (partial) retirement scenario the partial retirement age is 65 and the full retirement age is 70, and in the third (abrupt) retirement scenario the full retirement age is 70.

In each question, three attributes of the scenarios were randomized: pension income, the wage rate during partial retirement, and the duration of partial retirement.[4] For pension income (or the replacement rate), one of nine regimes is assigned, with each regime characterized by low, middle or high replacement rates in all three scenarios, and by low, middle, or high rewards for retiring later. The variation in the level of the replacement rates, irrespective of the retirement age, helps to identify the income effect of retirement income on the retirement decision; if leisure is a normal good, higher replacement rates are expected to lead to less labor supply and earlier retirement. This randomized regime allocation is referred to as the "income effect" regime. The replacement rates in the middle income effect regime assume a pension increase of 2.05% of earnings for each contribution year, which from 2006 to 2013 was the accrual rate of ABP, the largest Dutch pension fund, and many other defined benefit pensions in the Netherlands.[5]. The low and high income effect regimes use accrual rates 1.85% and 2.25%, leading to lower and higher replacement rates, respectively.

The variation in the rewards for retiring later changes the price of leisure and identifies a substitution effect. It is therefore referred to as the "substitution effect regime". The middle substitution effect regime gives approximately actuarially fair rewards (penalties) for later (earlier) retirement. In other words, the changes in the expected net present value of total pension income are approximately equal to the net present value of the additional premiums that are paid, based upon actuarial factors used by ABP to adjust pension rights due to later claiming; they depend on mortality rates and an interest rate. The yellow line in Figure 3 presents the factors for different retirement ages. The pension increase with each year retirement is delayed increases gradually with the retirement age, from about 3 percentage points (pp) at age 60 to 8 pp at age 69 in terms of the net replacement rate (cf. Kantarcı et al., 2013). The flatter red line and steeper green line underlie the "low substitution effect regime" and "high substitution effect regime" that give less and more than actuarially fair rewards for later retirement, respectively.

Table 1 presents the replacement rates for the nine combinations of the three income and the three substitution effect regimes. The first, second and third row always indicate a low, middle or high substitution regime, and the first, second and third column correspond to the low, middle, or high income regime. For example, the group low (accruals)/low (income) with retirement age regime 65 has replacement rates 60% for early retirement, (as of age 70) 75% for partial retirement, and 90% for late retirement. For the group high (accruals)/low (income), the respective replacement rates are 60%, 85% and 110%. The group high/low therefore gets a much higher reward for retiring later, or, in other words, pays a higher price for more leisure (in the form of retiring early). This group is therefore expected to substitute expensive leisure for relatively cheap consumption. In analogy to the labor supply literature, the difference between choices in the first row and the third row is referred to as the (uncompensated) substitution effect. On the other hand, if the replacement rates for the group low/low are compared to those of the group low/high (first row, last column: 80%, 95%, 110%), the compensation (in %-points) for retiring later (the "price of leisure") is the same, but pension income levels are much higher for the low/high than for the low/low group. Following the labor supply literature,

[4]Moreover, the order in which the first and the last retirement scenarios were presented is randomized.

[5]After 40 years of service, this yields an income replacement of 82% ($2.05\% \times 40$) of the average wage, including the flat-rate state pension.

Table 1: Replacement rates in competing retirement scenarios

Retirement age regime	Type of retirement	Full or partial retirement age	Replacement rate during partial retirement	Replacement rate during full retirement
65	E	65		0.60/0.70/0.80
				0.60/0.70/0.80
				0.60/0.70/0.80
	P	65-69	0.20/0.30/0.40	0.75/0.85/0.95
			0.25/0.35/0.45	0.80/0.90/1.00
			0.30/0.40/0.50	0.85/0.95/1.05
	L	70		0.90/1.00/1.10
				1.00/1.10/1.20
				1.10/1.20/1.30
63	E	63		0.50/0.60/0.70
				0.50/0.60/0.70
				0.50/0.60/0.70
	P	63-67	0.15/0.25/0.35	0.60/0.70/0.80
			0.20/0.30/0.40	0.65/0.75/0.85
			0.25/0.35/0.45	0.70/0.80/0.90
	L	68		0.70/0.80/0.90
				0.80/0.90/1.00
				0.90/1.00/1.10
61	E	61		0.40/0.50/0.60
				0.40/0.50/0.60
				0.40/0.50/0.60
	P	61-65	0.10/0.20/0.30	0.45/0.55/0.65
			0.15/0.25/0.35	0.50/0.60/0.70
			0.20/0.30/0.40	0.55/0.65/0.75
	L	66		0.50/0.60/0.70
				0.60/0.70/0.80
				0.70/0.80/0.90

Notes: 1. E, P, L denote, respectively, early, partial, and late retirement. 2. Considering the replacement rates row-wise, the first, second, and third rows refer, respectively, to the low, middle and high substitution effect regimes. Considering the replacement rates column-wise, the first, second, and third columns refer, respectively, to the low, middle and high income effect regimes. 3. The replacement rates for the short duration regime where partial retirement is 4 years, instead of 5 years here, are 5 pp lower when fully retired in the scenario of partial retirement, and 10 pp lower when fully retired in the scenario of late retirement, due to working, respectively, part-time and full-time one year less.

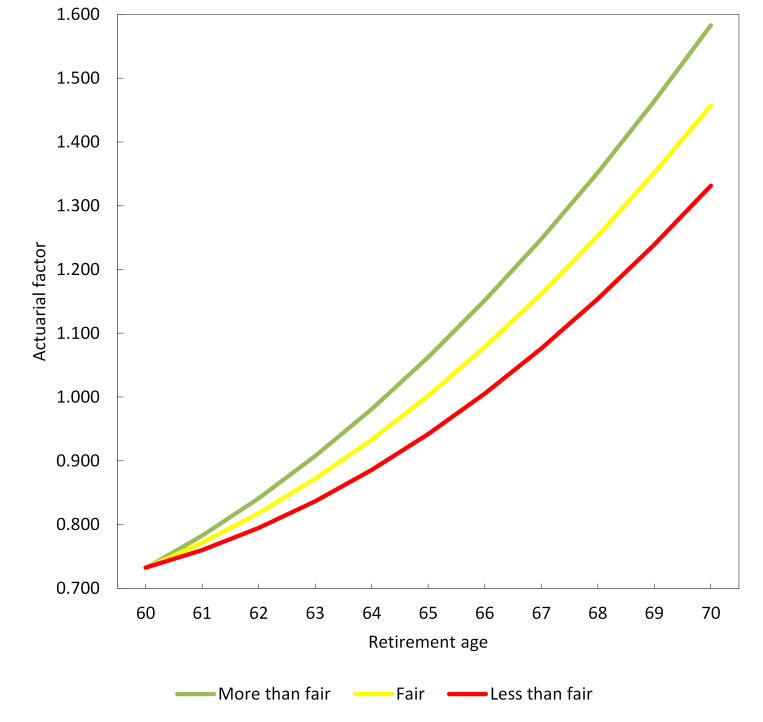

Figure 3: Actuarial factors that adjust pension rights due to claiming at different retirement ages.

the difference between the choices of low/high and low/low group are therefore referred to as an income effect.[6] This experimental setup allows us to disentangle substitution and income effects of pensions at both the intensive and extensive margins.

The levels of the replacement rates associated with a particular pension income regime depend on the retirement age regime for two reasons. First, the replacement rates decrease through earlier retirement age regimes 63 and 61 because pension benefits are actuarially adjusted for earlier claiming (using an actuarial factor less than 1 at the state pension age in Figure 3) and because those who retire earlier accumulate less pension rights. Second, at the earlier retirement age regimes, the increase in the replacement rates for delaying retirement is smaller because the actuarial increase for delaying benefits is smaller at earlier retirement ages (the increase in actuarial factors is nonlinear across retirement ages in Figure 3).

Several studies showed that labor market rigidities force employees to partially retire outside their main job for a lower hourly wage rate, due to, e.g., a part-time wage penalty or due to switching to a less demanding job (Hutchens, 2010; Aaronson and French, 2004; Ameriks et al., 2020). We investigate how individuals evaluate partial retirement when it is associated with a reduced wage rate or not. For this purpose, we define two regimes for the wage rate in partial retirement. In the first regime the employee reduces hours in the same job and for the same wage rate ("phased retirement"), while in the second regime hours are reduced by changing to a less demanding job with a 20% lower wage rate than the wage rate in the old job ("partial retirement" in the narrow definition; see Section 1).

For the third attribute, duration of partial retirement, we define two regimes with duration

[6]The substitution effect can be compared to the "price effect" of pension benefits and the income effect can be compared to the "wealth effect" of pension benefits in Euwals et al. (2010). The income effect can also be compared to the effect on retirement of a wealth shock through inheritance receipt (Brown et al., 2010).

four and five years. When partial retirement is four years, in the partial retirement scenario, replacement rates during full retirement are lower by 5 pp than those presented in Table 1 where partial retirement is 5 years, due to working part-time and accruing pension rights for one year less. A shorter partial retirement duration also means earlier full retirement in the late retirement scenario. There, replacement rates are 10 pp lower because of working full-time one year less.

We asked several follow-up questions: If respondents chose the partial retirement scenario in any of the questions on the choice between early, partial or late retirement, they were consequently asked to choose between the same early and late (abrupt) retirement scenarios. This helps to identify the labor supply effect of partial retirement: If more people choose the early retirement option than the late retirement option if the partial retirement option is omitted, this implies that partial retirement increases labor supply.

The respondents who choose the partial retirement scenario the first time in one of the three questions (each asking to choose among three scenarios) were asked two additional questions on partial retirement. In the first question, respondents choose among three scenarios of partial retirement that differ with respect to working 12, 20, and 28 hours per week during partial retirement. Higher numbers of weekly hours are associated with higher wages and lower pensions during partial retirement such that income replacement is fixed across the three vignettes. Higher numbers of weekly hours lead to higher pensions during full retirement due to accruing more pension rights in proportion to the number of hours worked. Respondents are randomized to one of three income effect regimes (low, middle, high replacement rates in all three scenarios), to three retirement age regimes (65, 63, 61), and to duration of partial retirement regimes (5 and 4 years). Table 6 in the appendix presents the replacement rates when partial retirement is 5 years.

In the second question, respondents choose between two scenarios with partial retirement: in the first, hours worked per week is 20 during partial retirement for four years, while in the other, it is 20 for two years, and subsequently 10 for another two years. In the latter partial retirement scenario, the lower number of weekly hours during the second stage of partial retirement is associated with a lower wage and higher pension during partial retirement such that income replacement is fixed across the two stages of this partial retirement scenario, and across the two partial retirement scenarios. In this scenario, pension income during full retirement is lower than that in the other partial retirement scenario, due to working less and claiming a higher pension during the second stage of partial retirement. Respondents are randomized to one of three income effect regimes (low, middle, high replacement rates in the two scenarios) and to three retirement age regimes (65, 63, 61). Table 7 in the appendix presents the replacement rates used in this question.

4 Data

The survey was fielded in 2017 in the Longitudinal Internet Studies for the Social Sciences (LISS) panel administered by Centerdata at Tilburg University in the Netherlands. The panel is based on a true probability sample of households drawn from the population register, covering the Dutch non-institutionalized population. It consists of approximately 5,000 households comprising 8,000 individuals who participate in monthly Internet surveys of about 15 to 30 minutes in total, and are paid for each completed survey. One member in the household provides the household data, and updates this information at regular time intervals. Households that could not otherwise participate are provided with a computer and Internet connection. A longitudinal survey is fielded in the panel every year, covering a large variety of topics including work, education, income, housing, time use, political views, values and personality. Our survey

was administered only to respondents aged 40 and older, generating 3,263 responses.

Table 2 presents figures on the sample composition. More than half are 60 years of age or older. About one third have higher vocational education or a university degree. Most are married or living together with a partner, and own the house they live in. More than one third are working for an employer, and about one third are retired. About half of the sample earn a net monthly income of 1,000 to 3,000 euros.

The bottom part of the table concerns two variables that are related to preferences for leisure and early or late retirement, and will be used in the empirical analysis to proxy variation in preferences that is normally unobserved. The first is the answer to the survey question "To what extent do you agree with the statement "I would work even if the money is not needed on a scale from 1 (strongly disagree) to 7 (fully agree). The second is to construct a proxy for planned (for those who did not yet retire) or realized (for those who retired) retirement behavior. We asked respondents to construct the sequence that corresponds as much as possible to their actual behavior or their current plans. For each two years age category 55-56, ..., 67-68, 69-plus, we asked them to indicate their dominant labor market status, choosing among full-time work, part-time work, or (fully) retired. See Appendix Figure 15 for the exact question and Appendix Table 8 for the most commonly reported sequences. In the model we will use a dummy "early retirement" defined as 1 if for the age categories 55-56, ..., 61-62, the respondent chooses "retired" at least once; for 16.89% of the sample, this dummy has value 1.

Table 3 presents choice fractions for competing retirement scenarios in the stated preference questions. Respondents more often choose partial retirement than both early and late retirement, demonstrating a preference for a smooth life-cycle profile of leisure and consumption. When the partial retirement option is omitted, slightly more of those who first chose partial retirement now choose early retirement rather than late retirement.

More people choose partial retirement if duration of partial retirement is five instead of four years. When wage rate in partial retirement is 20% lower than before (and partial retirement also implies a change to a less demanding job), partial retirement becomes less attractive. Partial retirement is more attractive if weekly hours worked is 20 than if it is 12 or 28. Whether hours worked is reduced in one or two steps hardly makes a difference.

Table 2: Sample composition

Attribute	Percent
Age	
40-49 years old	19.52
50-59 years old	24.81
60-69 years old	32.26
70 years old or older	23.41
Gender	
Male	52.09
Education	
Has higher vocational or academic education	34.98
Marital status	
Married or living with partner	72.69
Employment status	
Working for an employer	38.38
Retired	35.32
Working self-employed	5.91
Unemployed	3.40
Fully or partially disabled	4.95
Homemaker	8.04
Other	4.00
Home ownership	
Owner	75.19
Last monthly net labor income in euros	
0	5.06
1-1000	20.60
1001-2000	39.75
2001-3000	26.48
3001 or more	8.11
Would work even if money was not needed	
Strongly disagree	22.89
Disagree	21.06
Somewhat disagree	7.52
Not agree, not disagree	16.24
Somewhat agree	14.72
Agree	13.21
Totally agree	4.36
Experienced or expect early retirement	16.89

Note: Based on the responses of 3,233 individuals.

Table 3: Competing retirement scenarios

Scenario	Percent
E	28.74
P	40.42
L	30.84
E	50.78
L	49.22
E: P is 4 years	27.62
P: P is 4 years	39.59
L: P is 4 years	32.78
E: P is 5 years	29.68
P: P is 5 years	41.10
L: P is 5 years	29.22
E: Wage rate in P is same as in full-time work	27.62
P: Wage rate in P is same as in full-time work	42.72
L: Wage rate in P is same as in full-time work	29.66
E: Wage rate in P is 20% lower than in full-time work	29.85
P: Wage rate in P is 20% lower than in full-time work	38.16
L: Wage rate in P is 20% lower than in full-time work	31.99
P: 12 hrs/wk	29.94
P: 20 hrs/wk	41.43
P: 28 hrs/wk	28.63
P: 20 hrs/wk for 4 years	50.66
P: 20 and 10 hrs/wk in 2 successive periods of 2 years each	49.34

Note: E: Early retirement. P: Partial retirement. L: Late retirement.

5 Econometric model

Our model resembles the model used by Van Soest and Vonkova (2014). It does not explicitly incorporate uncertainty about future health, unemployment, wage growth, or savings, in line with the stylized scenarios in the stated preference questions. It is designed to use the stated preference questions to analyze the potential consequences of higher retirement age, pension incentives, and partial retirement for the labor supply decisions of older individuals.

We assume that the total utility, U_i^q, of retirement trajectory q for individual $i = 1, \ldots, n$ has the following form:

$$U_i^q = \sum_{t=60}^{100} \rho^{(t-60)} U_{it}^q \tag{1}$$

where ρ is the discount factor. Approximations of survival probabilities will be subsumed in ρ. U_{it}^q is the utility at age $t = 60, \ldots, 100$. The time horizon is fixed at 100 years of age. q is an early abrupt retirement trajectory (E), a partial retirement trajectory (P), or a late abrupt retirement trajectory (L). In all trajectories, the agent is working full-time at age 60. At later ages, leisure and income vary across trajectories.

Within period utility is specified as follows:

$$U_{it}^q = \alpha_{it}^l \ln\left(l_{it}^q\right) + \alpha^y \ln\left(y_{it}^q\right) + \alpha^{ly} \ln\left(l_{it}^q\right) \ln\left(y_{it}^q\right) \tag{2}$$

$$\alpha_{it}^l = X_i \beta^l + \eta^l t + e_i^l \tag{3}$$

$$e_i^l \sim N\left(0, \sigma_l^2\right) \text{ and } e_i^l \text{ independent of } X_i \tag{4}$$

$$l_{it}^q = T - h_{it}^q \tag{5}$$

T is the number of hours available for work and leisure in a working week and is a parameter to be estimated. $h_{it}^q \leq 40$ denotes hours of paid work per week and $h_0 = 40$ corresponds to full-time hours. At each age t, the person can work full-time ($h_{it}^q = h_0 = 40$), can be partially retired, or can be fully retired ($h_{it}^q = 0$).

y_{it}^q denotes net income. During full retirement, this is after tax pension, which replaces a certain fraction of preretirement after tax earnings according to a replacement rate. Independent of individual characteristics, replacement rates vary by design of the trajectories.

The preference parameter α_{it}^l drives the marginal utility of a change in leisure time due to (partial) retirement for respondent i at age t. It depends on a set of observed characteristics X_i such as age, gender and home ownership, and on respondent i's unobserved characteristics through e_i^l. The effect of age t is captured by $\eta^l t$. We expect that η^l is positive because people's valuation of leisure increases with age due to, e.g., deteriorating health.

The coefficient α^y determines the influence of a change in income on utility when there is no leisure time available. It is treated as a constant. It does not depend on age t since there would be a high correlation between $t \ln\left(y_{it}^q\right)$ and $t \ln\left(l_{it}^q\right)$ preventing estimation of both α^y and α_{it}^l.

The term $\alpha^y + \alpha^{ly} \ln\left(l_{it}^q\right)$ determines the influence of a change in income on utility. σ_l^2 reflects the degree of preference heterogeneity with respect to leisure.

As described in Section 3, respondents choose among retirement trajectories in a minimum of three and maximum of eight questions.[7] In the first question they choose among early abrupt retirement, partial retirement, and late abrupt retirement. In the second and third questions they evaluate the same three retirement trajectories but the retirement ages and

[7] Respondents also rate each trajectory on a discrete scale from 1 to 10. We asked this question to help them to become familiar with each of the choice opportunities.

replacement rates in the retirement trajectories are different in each question. In these questions respondents are randomly assigned a regime that changes the duration of partial retirement and the hourly wage during partial retirement. If respondents choose partial retirement over early and late abrupt retirement, in the follow-up questions they choose between early and late abrupt retirement, among three partial retirement plans with different numbers of hours worked per week, and among two partial retirement plans where number of weekly hours is reduced in one or two steps. In these questions respondents are randomly assigned a regime that changes the replacement rates and the hourly wage during partial retirement. We also randomize the duration of partial retirement in the question on number of hours worked in partial retirement.

Introducing errors terms u_i^q as in a standard random utility model (McFadden, 1998), the model takes the following form:

$$V_i^q = U_i^q + u_i^q \tag{6}$$

$$u_i^q \sim \text{i.i.d. type I extreme value and independent of } X_i, e_i^l \tag{7}$$

$$F(u_i^q) = e^{-e^{-u_i^q}} \tag{8}$$

where F denotes the cumulative distribution function.

The observed choice in question Q is given by

$$C_i^Q = q \text{ if } V_i^q > V_i^p \ \forall \ p \neq q. \tag{9}$$

Define $u_i^q - u_i^p \equiv u_i^{qp}$. The distributional assumption on u_i^q implies that u_i^{qp} has a standard logistic distribution. Furthermore, we assume that u_i^{qp} are i.i.d. across the questions. The probability of choosing scenario q among alternative scenarios j in question Q can then be stated as

$$P\left(C_i^Q = q \mid A_i, e_i^l\right) = \frac{e^{U_i^q}}{\sum_j e^{U_i^j}} \tag{10}$$

where $A_i = \{l_{it}^q, y_{it}^q, X_i, t, \beta^l, \eta^l\}$ is the set of all relevant individual and trajectory characteristics and parameters.

The estimation of the model is similar to the estimation of a mixed logit model and other random coefficient models as in, e.g., Revelt and Train (1998). These models are usually estimated by maximum simulated likelihood. The likelihood contribution for individual i, conditional on the unobserved heterogeneity parameter e_i^l, can be written as a one-dimensional integral of the product of the probabilities of the observed outcomes, C_i^Q, the answers to the choice questions of respondent i, as follows:

$$\int \prod_{Q=1}^{K(i)} P\left(C_i^Q = q \mid A_i, e_i^l\right) f\left(e_i^l\right) de_i^l \tag{11}$$

where f denotes the density function and $K(i)$ is the number of questions answered by respondent i (which varies from 3 to 15, due to the design of the survey).

Since it is not feasible to compute the integral numerically, we approximate the integral using simulated values of the random coefficient and use simulated maximum likelihood (Gouriéroux and Monfort, 1997), replacing the preceding integral with the following sum

$$\frac{1}{S} \sum_{s=1}^{S} \prod_{Q=1}^{K(i)} P\left(C_i^Q = q \mid A_i, e_{i,s}^l\right) \tag{12}$$

where S is the number of simulations and $e^l_{i,s}$ are random draws from a normal distribution with mean 0 and standard deviation σ_l. Usually a large number of pseudo-random draws is needed to assure a reasonably low simulation error in the estimated parameters. The number of draws and thus the time the estimation procedure takes can be reduced (keeping the same simulation variance) by using quasi-random numbers of Halton sequence (Train, 2009). 50 draws per individual is considered. Estimates of the covariance matrix of the parameter estimates are based upon asymptotic results, e.g., in Gouriéroux and Monfort (1990).

6 Estimation results

Table 4 presents the estimation results. The first ten rows present the coefficients β^l determining α^l_{it}. Many of the β^l parameters are significant, implying substantial observed heterogeneity with respect to leisure preferences. The large and significant estimate of the standard deviation of e^l_i implies there is also substantial variation in preferences that is not captured by observed respondent characteristics.

The significant negative estimate of age at the time of the survey suggests that older respondents attach less utility to leisure. This could be a cohort effect, but it also might mean that older individuals more often realize the risk of not being able to meet their consumption needs in retirement and hence see the need to work longer. Respondents with a partner attach more value to leisure than singles, possibly due to a desire for joint leisure activities or the need for home production. Those with more housing wealth derive more utility from leisure, possibly because they can better afford it. Those who had a health problem during the six months prior to the survey also attach more value to leisure, probably since they also expect health issues in the future, implying an increasing disutility of working longer.

The variable "would work even if money was not needed" can be seen as a proxy for a low disutility of work, or even a positive marginal utility of working at least a few hours, keeping income and other variables constant.[8] In line with what one would expect, individuals with a low disutility of work tend to prefer later retirement and have a lower marginal utility of leisure (keeping other variables constant). Finally, those who expect or experienced early retirement tend to choose scenarios with more leisure, corresponding to a higher marginal utility of leisure, showing a significant positive relation between revealed preferences ((planned) actual retirement) and stated preferences. This strong positive relationship can be seen as a validation of the stated preference questions (cf. Michaud et al., 2020).

The significant positive estimate of η^l implies that respondents attach increasing utility to leisure at older ages, probably because they expect that health deterioration will increase the disutility of working. It could also be that a social norm or the expected labor market position of the partner or their reference group makes working at an older age less and less attractive.

The estimates of α^y and α^{ly} cannot be interpreted directly. They determine the shape of the within period utility function and (together with α^l_{it}), drive the sensitivity of retirement decisions for financial incentives.

The estimate of the discount factor ρ is 0.91 with a standard error of only 0.006. This also captures the mortality rate since mortality is not explicitly taken into account.[9]

The estimate of T suggests that available leisure time is about 10 hours in a typical 38 hours of working week in collective labor agreements in the Netherlands.

[8] See, e.g., Börsch-Supan and Schuth (2014), who argue that early retirement negatively affects social networks and cognitive functioning.

[9] The probability to survive from age 65 to age 80 was 0.672 in 2013, giving an average mortality rate of 2.7%, so corrected for mortality, the estimated value of ρ would be approximately 0.94.

Table 4: Estimation results

Parameter	Estimate	Standard error	t value
β^l: constant	−9.114	0.614	−14.833
β^l: age	−1.129	0.112	−10.087
β^l: male	−0.267	0.024	−11.319
β^l: high education	−0.053	0.021	−2.504
β^l: household with no children	0.027	0.032	0.840
β^l: with partner	0.081	0.023	3.531
β^l: home owner	0.067	0.026	2.628
β^l: had a health problem in the last six months	0.084	0.022	3.852
β^l: would work even if money was not needed	−0.104	0.007	−15.232
β^l: experienced or expect early retirement	0.314	0.033	9.599
η^l	0.124	0.008	16.238
σ_l	0.556	0.028	19.491
T	47.854	0.972	49.232
α^y	−0.449	0.127	−3.535
α^{ly}	0.351	0.027	13.063
ρ	0.907	0.006	158.396

Note: Estimation is based on the responses of 3,233 individuals who participated in the survey.

We evaluate model fit based on a comparison of the choice probabilities in the survey with the average of the probabilities predicted by the model for each individual. We consider only the questions asking to choose among early, partial and late retirement, asked three times changing the retirement ages in the retirement scenarios, since these questions are asked to all respondents; other questions are asked conditional on the choice of partial retirement in these three questions (Section 3). Model predictions are based on the estimation using all questions asked in the survey. Table 9 shows that the observed and predicted choice probabilities are fairly close to each other although partial retirement is underestimated by about 5 pp. This owes to the fact that we fit the model to data from all questions, which is apparently somewhat demanding; we choose to do so because this increases the efficiency of our estimates. When we use only the questions asking to choose among early, partial and late retirement in the estimation, the observed and predicted choices for partial retirement differ by 3.4 pp.

7 Simulations

We use the estimated model to simulate the effects of potential policy changes on retirement decisions, focusing on partial retirement. We first simulate the choice probabilities for early, late and partial retirement scenarios (of the same type in Figure 2) at various retirement ages as our benchmark. We then study how the choice probabilities change when the statutory retirement age is increased, when pension incentives change, or when wage compensation during partial retirement changes. The retirement scenarios considered in the simulations are based on the original experimental design described in Section 3, but replacement rates are adapted to the alternative retirement ages (to account for the total number of years of pension accrual and actuarial adjustments to pensions at those ages). As described in Section 3, three attributes of the retirement scenarios are randomized: the pension income, the wage rate during partial retirement, and the duration of partial retirement. In each simulation, we pool individuals assigned to the regimes defined for these attributes, unless the simulation concerns changing

the specific attribute. Simulated choice probabilities are averaged over the complete sample, and take into account observed and unobserved heterogeneity as well as optimization errors.

Increasing the statutory retirement age

Figure 4 shows the average probabilities of choosing early, partial and late retirement as a function of the age of abrupt or partial retirement: the first point on the left is a choice between abrupt (early) retirement at age 60 (with a low pension), partial retirement from age 60 to age 64 (or 63 if duration of partial retirement is 4 years) and full retirement thereafter, or abrupt (late) retirement at age 65 (or 64 if duration of partial retirement is 4 years). Moving along the horizontal axis gives the same probabilities if all these ages increase by 1, 2, ... 6 years. Hence, on the right-hand side, the choice is among abrupt early retirement at age 66, partial retirement from age 66 until age 70 (or 69), or abrupt retirement at age 71; the three choice probabilities always add up to 100%. When the statutory retirement age increases, the probability of early retirement increases and the probability of late retirement falls. For example, increasing the retirement age from 61 to 63 increases the probability of early retirement by about 10 pp (from 0.2 to 0.3). The probability of partial retirement, however, is always between 32 and 35%, demonstrating the potential of partial retirement schemes, particularly if full-time working becomes unattractive due to an increase of the statutory retirement age.

In the context of the life-cycle labor supply and retirement model of Rogerson and Wallenius (2013), Ameriks et al. (2020) demonstrate that those with a low intertemporal elasticity of substitution (IES) highly value the option of part-time work for a smooth life-cycle profile of leisure and consumption, while those with a high IES will often choose abrupt retirement. The strong interest in partial retirement that we find therefore implies that there is a substantial group of individuals who have a low IES. The probabilities to choose partial retirement are much larger than the fraction of workers who actually choose partial retirement (Kok et al., 2018), pointing at other (demand side) restrictions that hamper part-time work and partial retirement in practice.

Changing the characteristics of the partial retirement plan

Figure 5 compares simulated choice probabilities when duration of partial retirement is either four years or five years with actuarially adjusted pension levels; accordingly, in the late abrupt retirement option, retirement starts either four or five years later than in the early retirement option. At earlier retirement ages, a longer partial retirement period makes partial retirement more attractive, at the cost of late retirement. The probability to choose early retirement is rather low irrespective of the partial retirement duration. This is different at later retirement ages – here the duration of partial retirement hardly matters for how many people choose partial retirement. With the longer partial retirement duration, more individuals choose early retirement rather than partial retirement if the retirement age increases (they do not want to work for an extra year, not even part-time), but at the same time many individuals switch from late retirement to partial retirement – they prefer an extra year part-time to an extra year full-time.

Figure 6 shows the choice probabilities for three different numbers of hours worked during partial retirement: 12, 20 or 28 hours. The differences in the choice probabilities are notable. At a low retirement age, partial retirement with 28 hours of work per week is an often chosen alternative for full retirement. At higher retirement ages, the situation reverses and working 28 hours is often not attractive, like full time work. At a high retirement age, partial retirement with a small part-time job is often chosen as a good alternative for early retirement.

Figure 7 presents the choice probabilities when the number of weekly hours worked is reduced in one step (from 40 to 20 hours per week) or in two steps (first from 40 to 20 hours, after two years from 20 to 10 hours per week). In the latter case total labor supplied is smaller due to working fewer hours during the second half of partial retirement. At earlier retirement ages, two steps are less attractive than partial retirement in one step. For the higher retirement ages, there is hardly any difference between the probabilities for the one and two steps partial retirement plans.

Existing studies provide evidence that older workers who take a part-time job before they fully retire often work at a reduced hourly wage, due to a part-time wage penalty or to switching to a less demanding job (Gordon and Blinder 1980; Gustman and Steinmeier 1985; Ruhm 1990; Aaronson and French 2004; Rogerson and Wallenius 2009). Figure 8 shows simulated choice probabilities when hourly wages in partial retirement are the same as when working full-time prior to partial retirement, and when they are 20% lower or higher. The partial retirement option clearly becomes more attractive for a higher wage during partial retirement, irrespective of the retirement age. A reduction in the hourly wage mainly induces many individuals to choose to continue working full-time rather. On the other hand, an increase in the hourly wage rate (e.g., induced by a subsidy of gradual retirement) induces many people who otherwise would have stopped working early to participate in partial retirement.

Financial incentives

Figure 9 shows simulated choice probabilities when pension accruals are based on an accrual rate of 2.05% (the benchmark), 1.85%, or 2.25%, giving lower and higher pension levels than in our experimental design, see Section 3. The alternative accrual rates imply replacement rates that are 10 pp lower or higher than the replacement rates implied by the benchmark accrual rate of 2.05% (Table 1). The effects we find are in line with the notion that leisure is a normal good: a higher replacement rate implies more early retirement and less late retirement. The probability to choose partial retirement does not change much. The effects are sizable compared to the existing literature. For example, for the US, Van der Klaauw and Wolpin (2008) find that a 25% reduction in Social Security benefits reduces labor participation of both husbands and wives aged 51-61 to a limited extent but increases labor participation of individuals aged 62-69. Delavande and Rohwedder (2017) find that individuals would expect to work longer and reduce spending if their Social Security benefits were cut by 30%. For Ukaine, Danzer (2013) found that a 10% rise in the minimum pension level increases the probability of retiring by 1.2% for women and 1.9% for men.

Figure 10 shows what happens if rewards for later retirement are based on higher or lower actuarial factors than those used by the largest Dutch pension fund, using the factors shown in Figure 3. Higher rewards for later retirement substantially reduce the probability to choose early retirement. Particularly if the statutory retirement age is high, it increases the probability of partial retirement more than the probability of late (abrupt) retirement. Apparently, the higher rewards are not enough to make people work full-time until high age, but they do convince people to continue working part-time. To the best of our knowledge this is the first evidence on the price effect of pensions on the partial retirement decision.

The added value of partial retirement

Figure 11 shows how the choice probabilities for early and late retirement change when the partial retirement option is omitted. Choice probabilities for early and late retirement both increase at every retirement age, and the increase is always larger for early retirement than for late retirement. Since in this simulation partial retirement always means working half-time, this

suggests that introducing the option of partial retirement has a positive impact on total labor supply. This positive effect is larger at later statutory retirement. This is plausible: since the propensity of early retirement increases at later statutory retirement ages, partial retirement more often becomes an attractive alternative to early retirement.

This result is in line with Ameriks et al. (2020) who find that older individuals in the US would work longer if they had opportunities to work in jobs that allow them to choose hours worked per week or weeks worked per year. For Germany, Huber et al. (2016), Berg et al. (2020), and Haan and Tolan (2019) also conclude that encouraging partial retirement can lead to positive labor supply effects. These findings differ from those of several other studies. Börsch-Supan et al. (2018) exploited cross-country variation in pension systems with respect to whether they adopted partial retirement schemes, to explain differences in annual labor force participation and work hours between these countries. Van Soest and Vonkova (2014) and Elsayed et al. (2018) conduct stated choice experiments including partial retirement in the Netherlands. These studies find that partial retirement reduces total labor supply. A possible explanation is that the aggregate labor supply effect depends on the details of the partial, early and late scenarios that individuals can choose.

Subsidizing partial retirement

Until now, we essentially assumed that partial retirement was rewarded in an actuarially neutral manner. Individuals have maximum flexibility and pay a fair price for retiring partially. Recently, however, labor unions and employers introduced subsidized partial retirement schemes ("Generation pact") in collective labor agreements; see, e.g., Rutten et al. (2022) for details on how this is implemented in parts of the public sector. At any age from, for example, five years before the state pension eligibility age until this age, these schemes allow a worker to reduce work hours with a less than proportional decrease in salary and no reduction in pension accruals. The schemes do not allow to claim pension rights during partial retirement. Sector agreements differ in how much weekly hours can be reduced and how much they subsidize the salary; they typically offer multiple options. For example, the collective labor agreement of Dutch universities states that employees can work 80% of their former hours and earn 85% of their former wage, or they can work 60% of the former hours and earn 70% of the former wage. In both variants employees accrue pensions rights over 100% of their former wage. They can also switch from the first to the second variant after one year.

Figures 12 through 14 present the choice probabilities for the three variants of this arrangement, comparing them to the benchmark of the standard actuarially neutral partial pension arrangement. In Figure 12, the subsidized partial retirement option means the employee works 80% of former hours and earns 85% of the former wage, while in the benchmark partial retirement option she works 80% of former hours and earns 80% of the former wage. Moreover, in the subsidized partial retirement option, pension rights accrue over 100% of the former wage, while in the benchmark partial retirement option, they accrue over 80% of former wage. We consider decisions at each age from 62 to 65, each lasting until age 67 (the state pension eligibility age in 2024). Therefore, duration of partial retirement depends on the age partial retirement starts. The other two figures make similar comparisons, but for the other two variants (work 80% in the first year and 60% in later years until the statutory age, or immediately work 60% in all partial retirement years). Table 5 provides the details. The figures show that the subsidies make partial retirement substantially more attractive, particularly if offered at an early stage so that individuals benefit from the subsidy for a longer period (five years). The two step variant gives the largest effect of the subsidy: the probability to choose partial at age 62 would increase by 10 pp. The reductions in the probabilities of early and late retirement are almost the same. Since

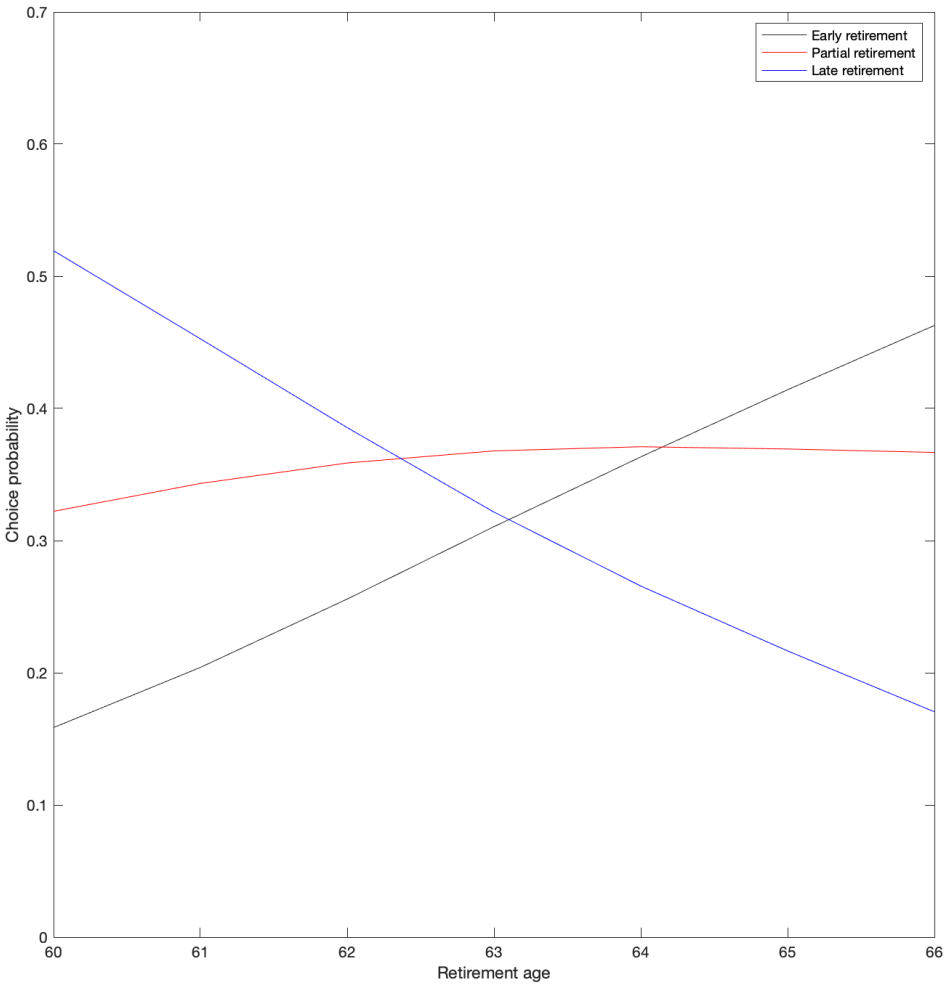

Figure 4: Probabilities of choosing among early, partial and late retirement at given ages.

in this set up partial retirement implies working more than half-time, the effect on total labor supply would be positive. This suggests that wage compensation is an important determinant of the preference for partial retirement. This is in line with Figure 8 where simulated decisions are shown to be sensitive to hourly wages during partial retirement.

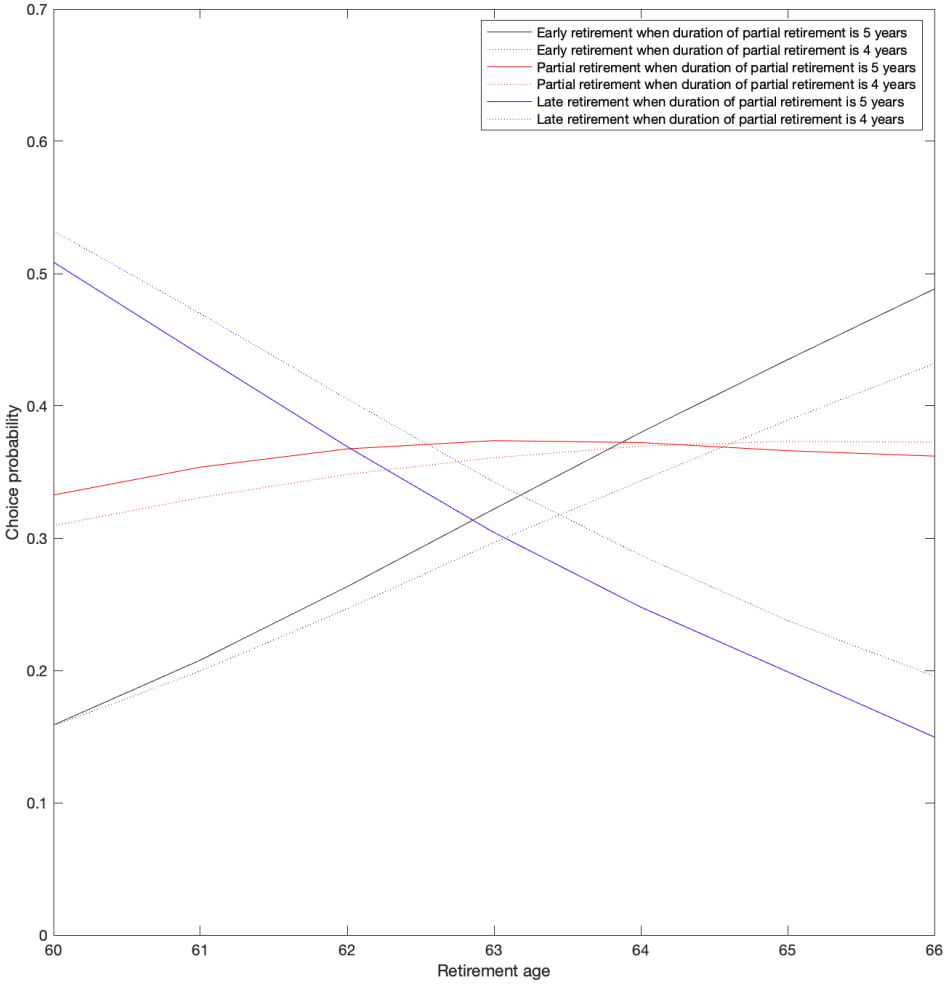

Figure 5: Probabilities of choosing among early, partial and late retirement at given ages, distinguishing between partial retirement for 5 and for 4 years.

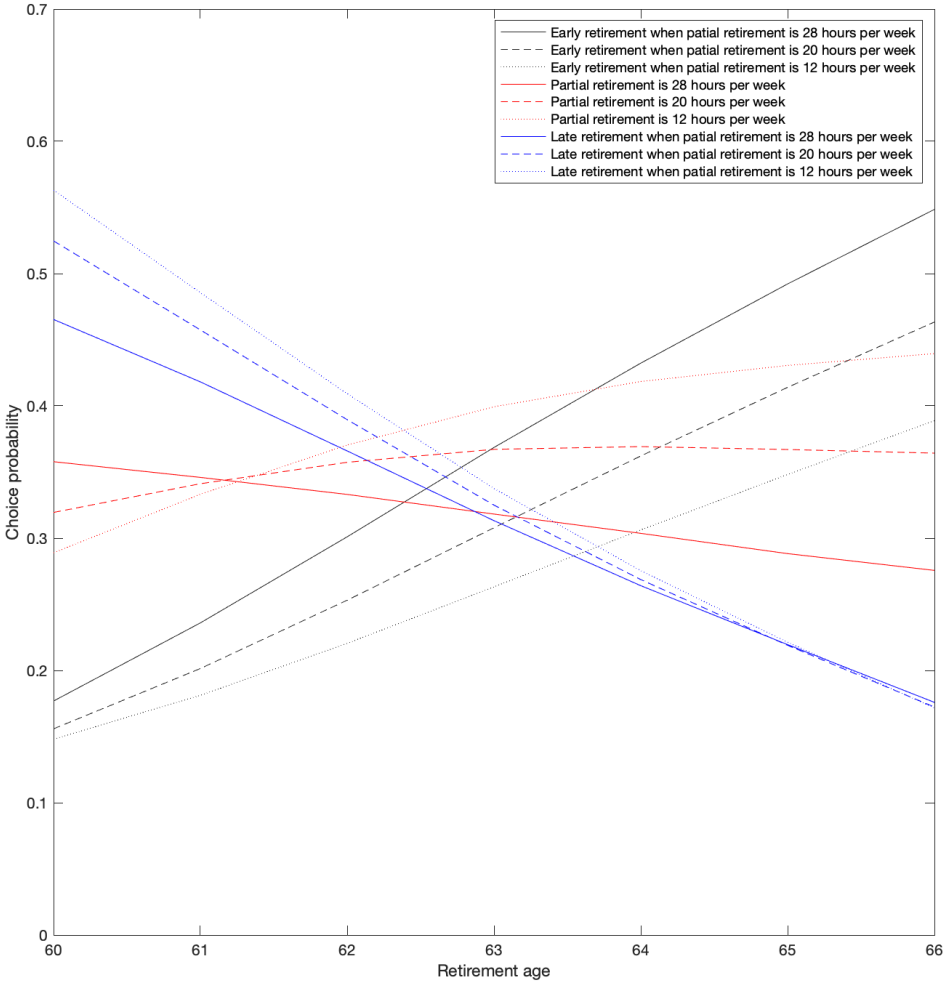

Figure 6: Probabilities of choosing among early, partial and late retirement at given ages, distinguishing among partial retirement with 28, 20 and 12 hours per week.

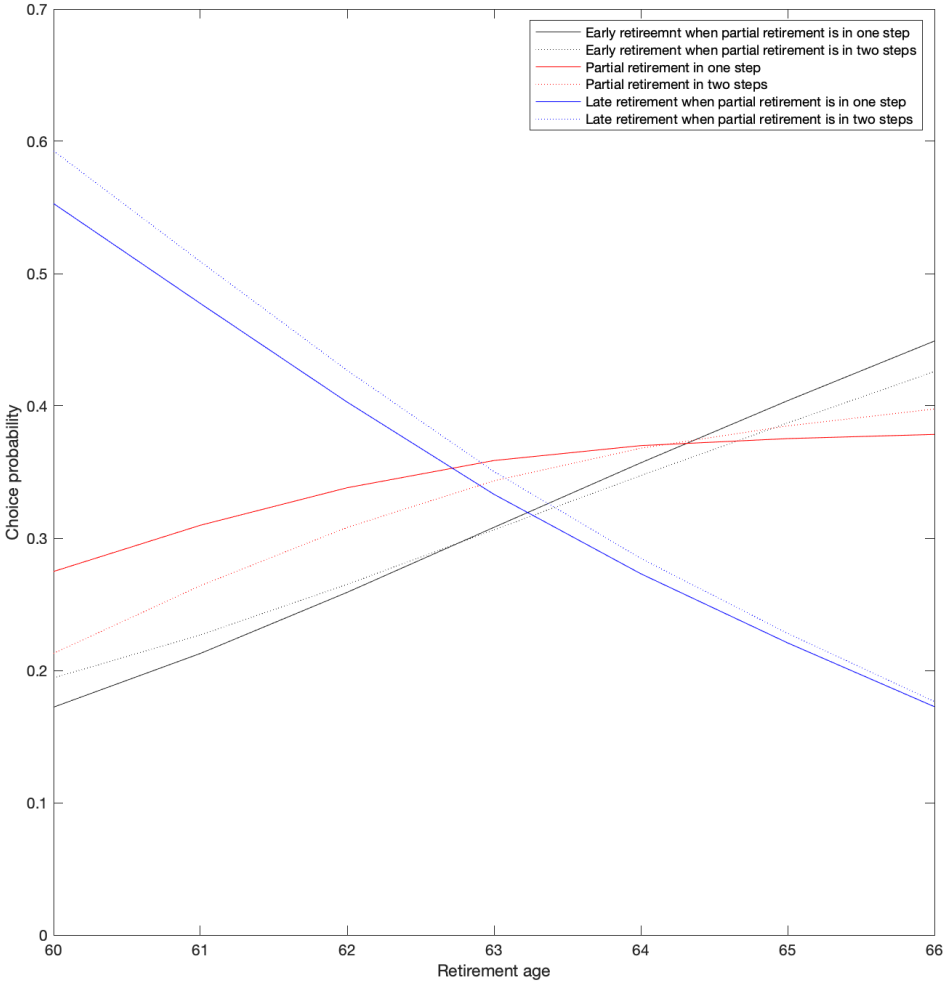

Figure 7: Probabilities of choosing among early, partial and late retirement at given ages, distinguishing between partial retirement in 1 and 2 steps.

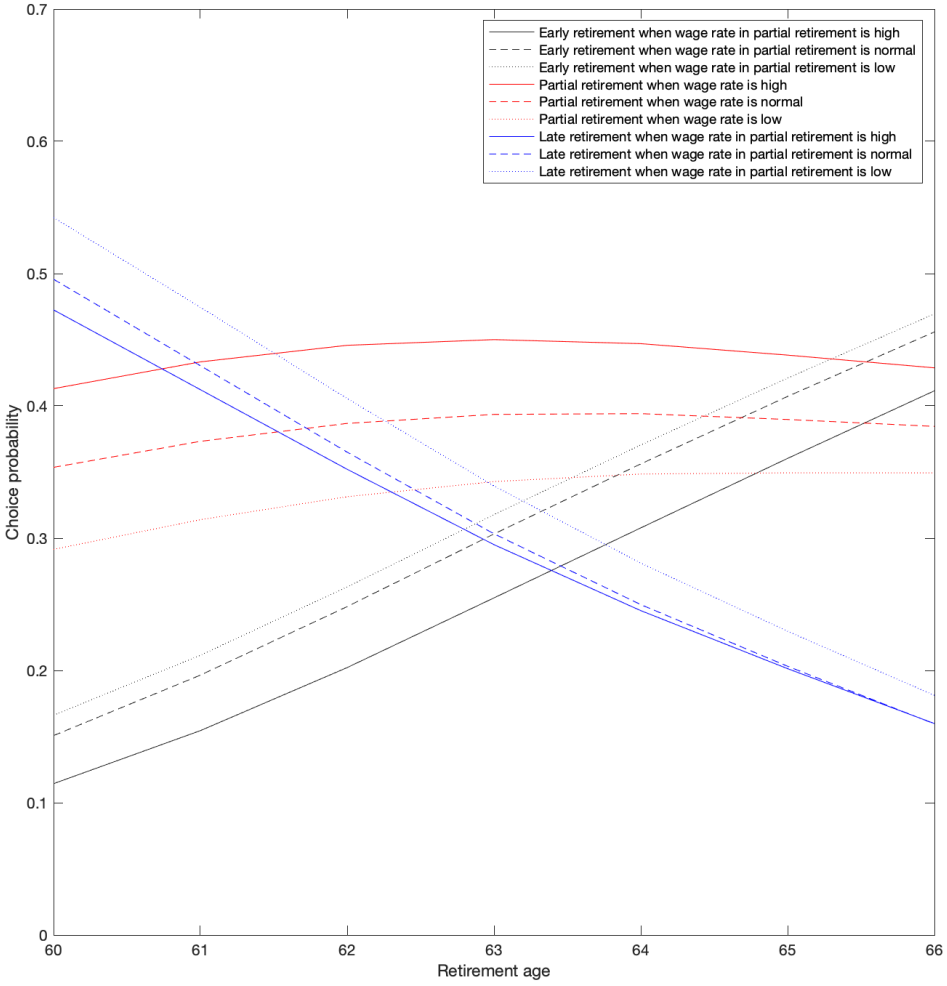

Figure 8: Probabilities of choosing among early, partial and late retirement at given ages, when the wage rate during partial retirement changes.

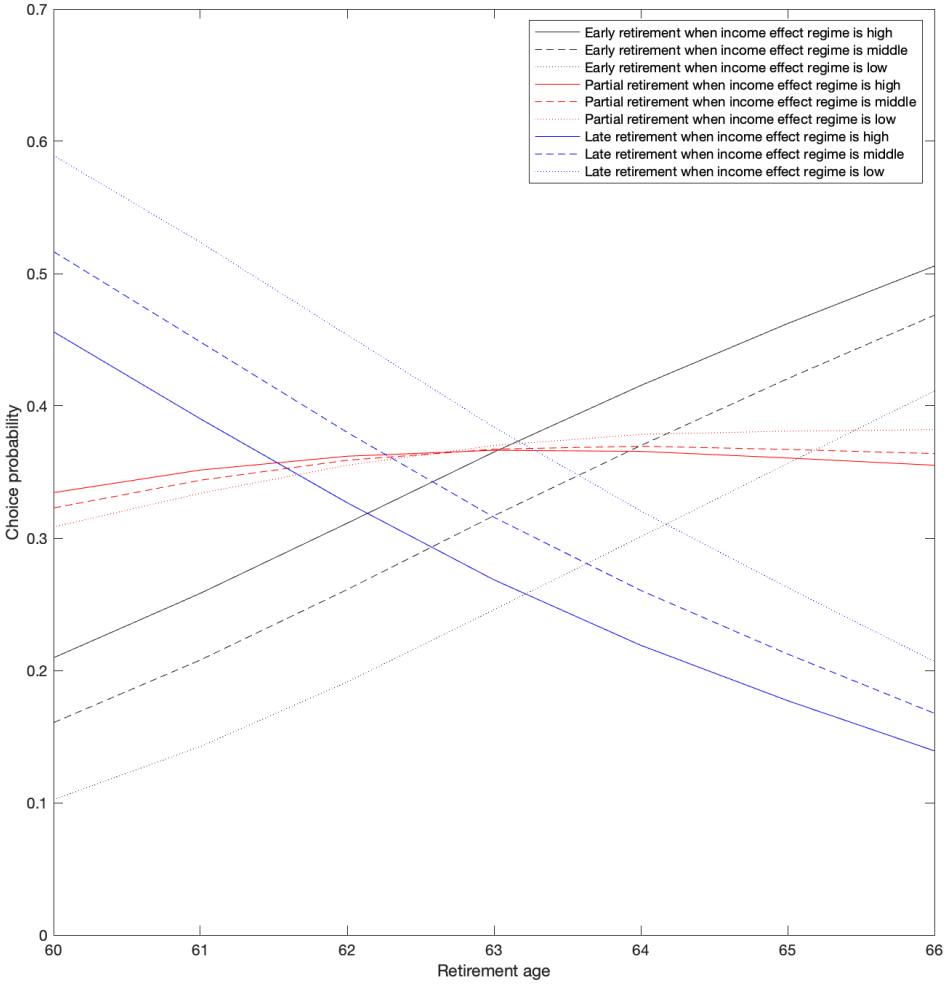

Figure 9: Probabilities of choosing among early, partial and late retirement at given ages, when pension benefit levels change irrespective of the retirement age.

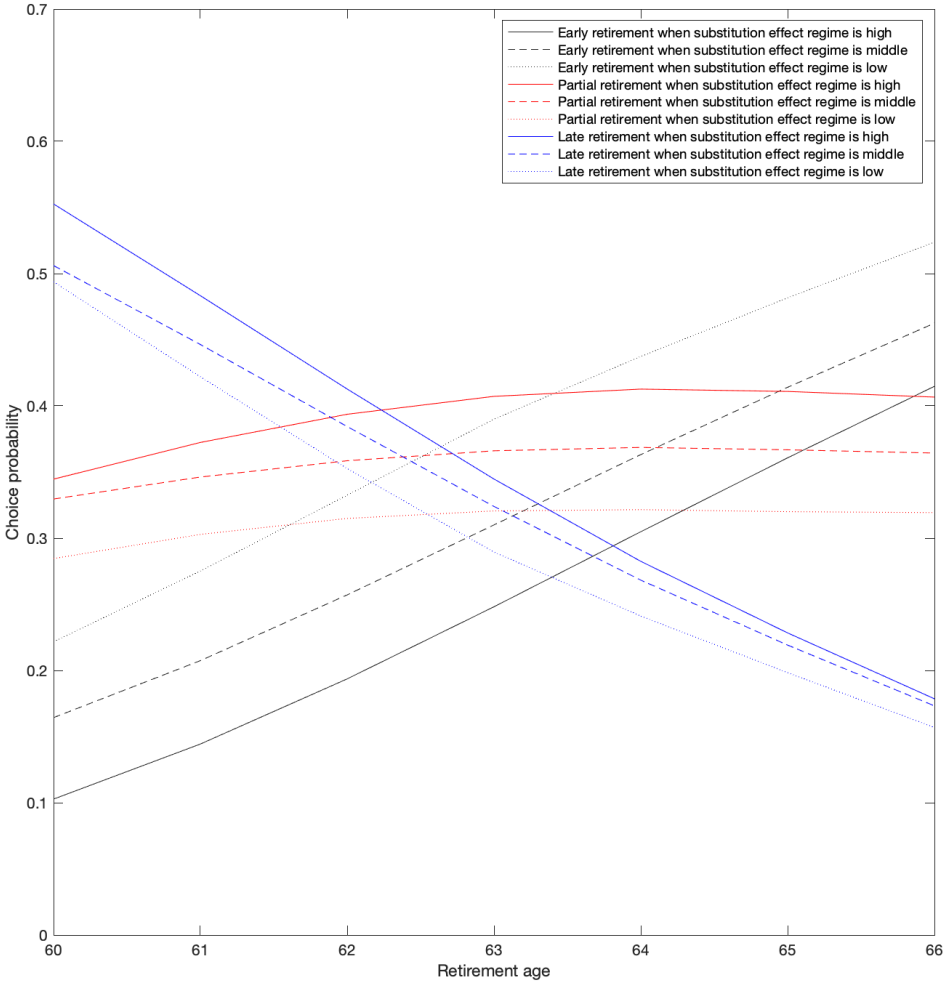

Figure 10: Probabilities of choosing among early, partial and late retirement at given ages, when the pension benefit accrual induced by delaying retirement changes.

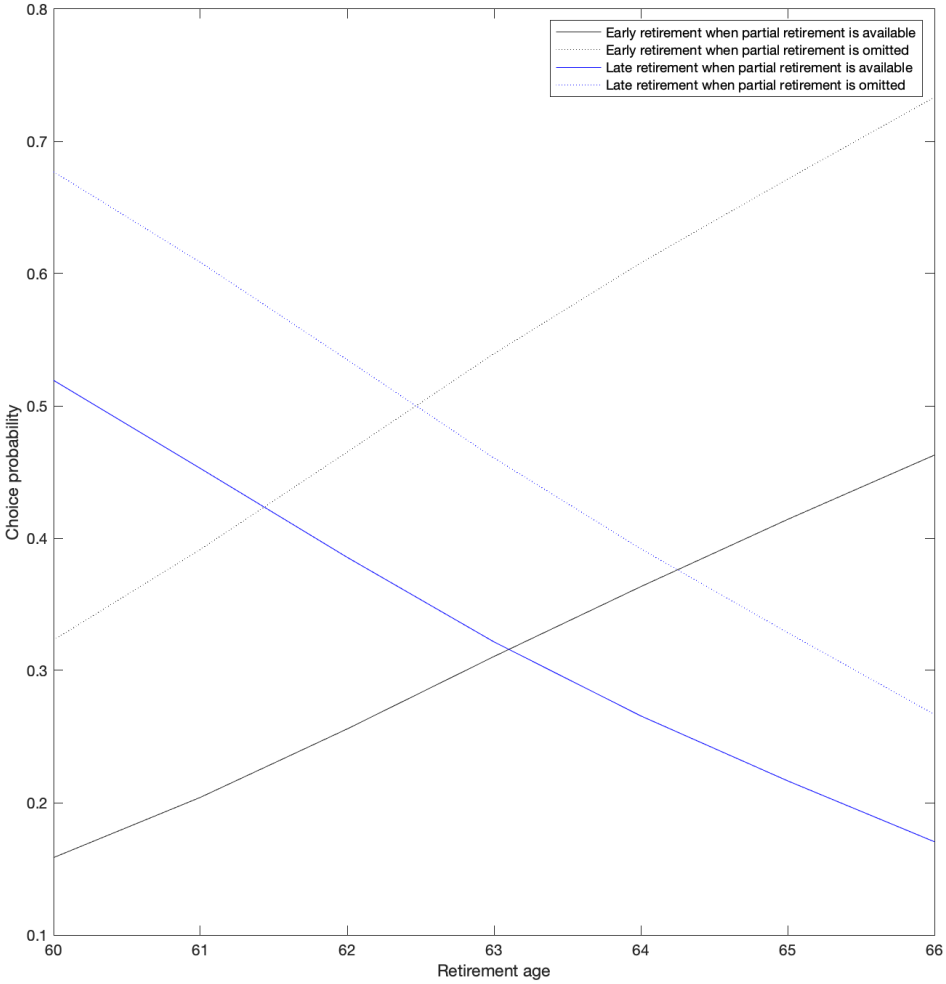

Figure 11: The effect of introducing partial retirement on total labor supply.

Table 5: Competing subsidized and default partial retirement scenarios

Simulation exercise	Steps of partial retirement	Generation pact regime	ABP regime
1	1st and only step	0.80 work	0.80 work
		0.85 wage	0.80 wage
		1.00 pension accrual	0.80 pension accrual
2	1st step of 2 steps	0.80 work	0.80 work
		0.85 wage	0.80 wage
		1.00 pension accrual	0.80 pension accrual
	2nd step of 2 steps	0.60 work	0.60 work
		0.70 wage	0.60 wage
		1.00 pension accrual	0.60 pension accrual
3	1st and only step	0.60 work	0.60 work
		0.70 wage	0.60 wage
		1.00 pension accrual	0.60 pension accrual

Notes: To make the scenarios comparable except for the subsidy, there is also no partial pension during partial retirement in the non-subsidized case.

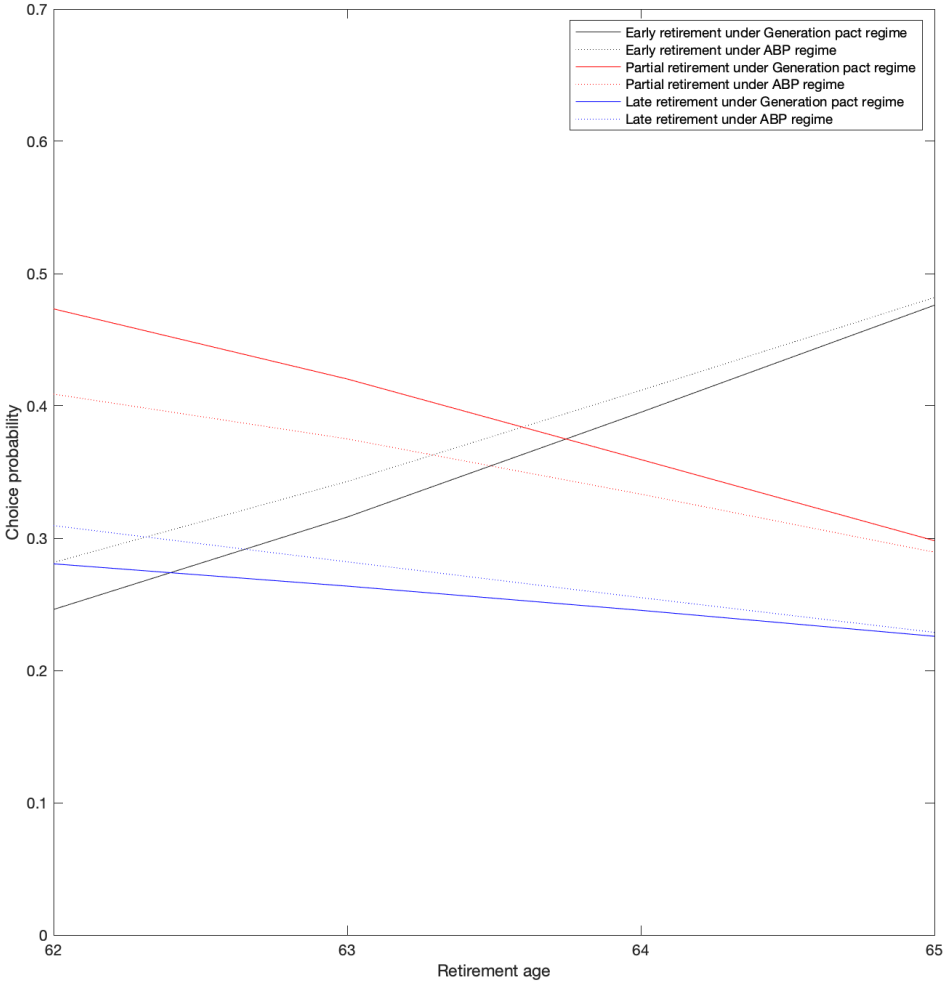

Figure 12: Generation pact: 80% work, 85% compensation and 100% pension accrual.

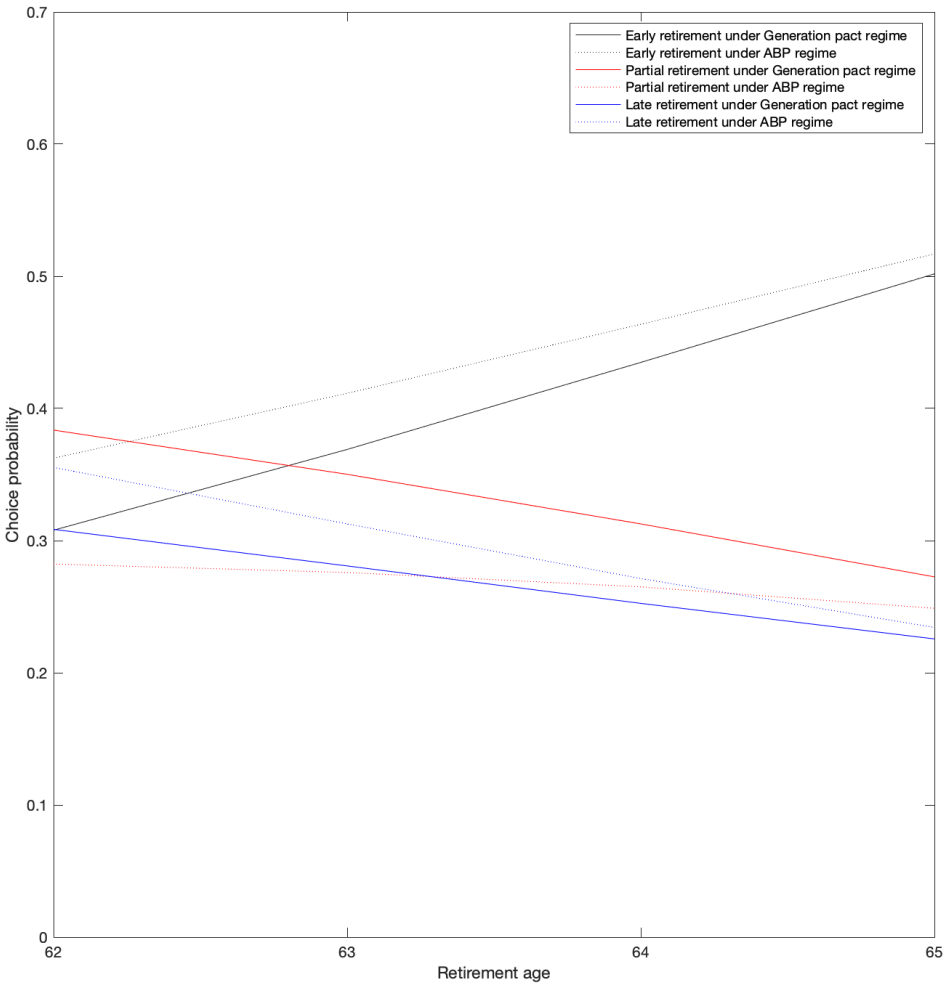

Figure 13: Generation pact: 80% work, 85% compensation and 100% pension accrual in the first year, and 60% work, 70% compensation and 100% pension accrual in the remaining years of partial retirement.

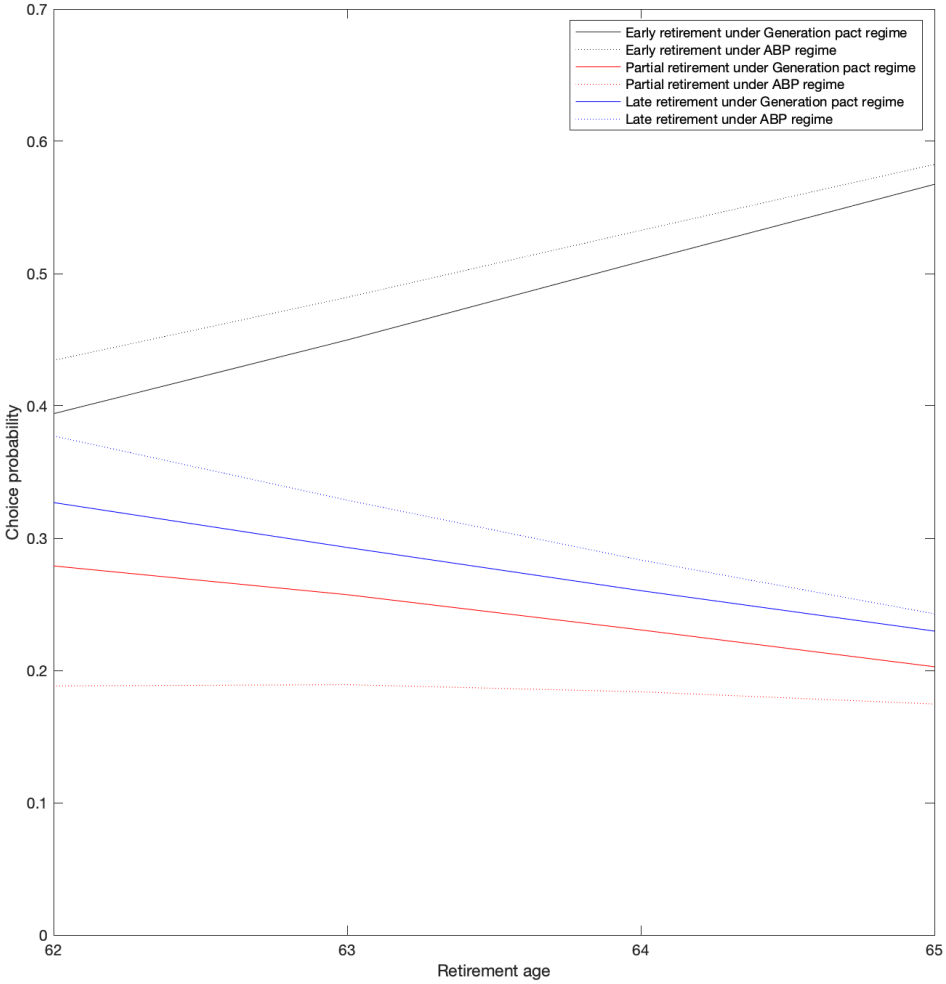

Figure 14: Generation pact: 60% work, 70% compensation and 100% pension accrual.

8 Conclusion

Partial retirement seems an attractive way to gradually withdraw from the labor market, avoiding the sudden change in time use and activities of abruptly switching from full-time work to no paid work at all. This is in line with standard models of labor supply in which individuals prefer to smooth leisure and consumption over the life cycle. In practice, however, partial retirement is less common than one might expect on the basis of preferences alone, due to demand side restrictions or institutional constraints. In this paper, we have followed several recent papers by studying partial retirement using stated choice survey questions, aiming at an analysis of labor supply preferences only, purged from the restrictions that someone's actual labour market position may impose. Our questions provide a more detailed picture of partial retirement than existing studies by considering several properties of the partial retirement option, such as the starting and ending age, the hourly wage rate, the number of hours worked, and whether the transition to full retirement involves multiple steps or not. We use vignette questions asking respondents to make choices based upon their own preferences but for hypothetical individuals, making it possible to ask respondents to make choices that are not realistic in their own situation. We account for the standard actuarial rules of pension systems, making the trade offs between income and leisure as realistic as possible.

The labor supply preferences that we estimate correlate in plausible ways with peoples' actual or predicted retirement plans and with a subjective question on whether they value work just for money or for its intrinsic value. This lends credibility to our stated choice data and can be seen as a validation exercise. We randomly vary retirement plan characteristics in several questions across respondents, generating rich variation in choice sets and stated choices. We exploit this variation to obtain accurate model estimates and conduct credible counterfactual policy simulations.

We find substantial interest in partial retirement scenarios, with more than one third of the respondents choosing partial retirement rather than actuarially fair early or late abrupt retirement trajectories. The probability to choose partial retirement hardly varies with the statutory retirement age. The fact that stated interest in partial retirement is stronger than the actual prevalence of partial retirement suggests that actual partial retirement is often hampered by demand side restrictions.

Using the stated choice data, we estimate a stylized model that makes the trade-offs between leisure and income over the life cycle as of age 60 explicit. Responses to pension incentives, for both abrupt and partial retirement, are sizable compared to those found in earlier studies, considering that the sizes of the incentives we consider are much smaller. This is important because small pension incentives are much more within the reach of policy makers who have to carefully consider pension interventions.

We disentangle accrual and wealth effects of pensions at both the intensive and extensive margins at various retirement ages. We find that the partial retirement decision is much less sensitive to wealth effects than the decisions for early or late abrupt retirement. On the other hand, it is sensitive to pension accruals. More importantly, the partial retirement decision strongly depends on the specific financial incentives for retiring partially. Interest in partial retirement would fall substantially if partial retirement came with a substantially lower wage (and a less challenging job). Accordingly. the potential interest in partial retirement increases if partial retirement is subsidized by one of the special programs that is used in the Dutch public sector to stimulate older workers to remain active in a part-time job.

Finally, if individuals do not have the partial retirement option, early abrupt retirement more often becomes the best alternative than late retirement, demonstrating the potential of partial retirement as a policy instrument to stimulate older individuals remain in the labor force.

Policy makers can harness this potential as they consider increasing the statutory retirement age to keep pension systems sustainable because in fact we show that this potential is more pronounced when the statutory retirement age is increased.

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Appendix

Table 6: Replacement rates in competing partial retirement scenarios with different numbers of hours worked per week during partial retirement

Retirement age regime	Partial retirement age	Hours worked during partial retirement	Replacement rate during partial retirement	Replacement rate during full retirement
65	65-69	12	0.45/0.55/0.65	0.75/0.85/0.95
	65-69	20	0.25/0.35/0.45	0.80/0.90/1.00
	65-69	28	0.05/0.15/0.25	0.85/0.95/1.05
63	63-67	12	0.40/0.50/0.60	0.60/0.70/0.80
	63-67	20	0.20/0.30/0.40	0.65/0.75/0.85
	63-67	28	0.00/0.10/0.20	0.70/0.80/0.90
61	61-65	12	0.35/0.45/0.55	0.45/0.55/0.65
	61-65	20	0.15/0.25/0.35	0.50/0.60/0.70
	61-65	28	0.00/0.05/0.15	0.55/0.65/0.75

Notes: 1. Considering the replacement rates column-wise, the first, second, and third columns refer, respectively, to the low, middle and high income effect regimes. 2. The replacement rates for the short duration regime where partial retirement is four years, instead of five years here, are 5 pp lower when fully retired in scenarios of partial retirement, and 10 pp lower when fully retired in scenarios of late retirement, due to working, respectively, part-time and full-time one year less.

Table 7: Replacement rates in competing partial retirement scenarios where hours are reduced in one or two steps during partial retirement

Retirement age regime	Partial retirement age	Partial retirement in one or two steps	Replacement rate during the first step of partial retirement	Replacement rate during the second step of partial retirement	Replacement rate during full retirement
65	65-68	1	0.25/0.35/0.45		0.75/0.85/0.95
	65-68	2	0.25/0.35/0.45	0.50/0.60/0.70	0.70/0.80/0.90
63	63-66	1	0.20/0.30/0.40		0.60/0.70/0.80
	63-66	2	0.20/0.30/0.40	0.45/0.55/0.65	0.55/0.65/0.75
61	61-64	1	0.15/0.25/0.35		0.45/0.55/0.65
	61-64	2	0.15/0.25/0.35	0.40/0.50/0.60	0.40/0.50/0.60

Notes: Considering the replacement rates column-wise, the first, second and third columns refer, respectively, to the low, middle and high income effect regimes.

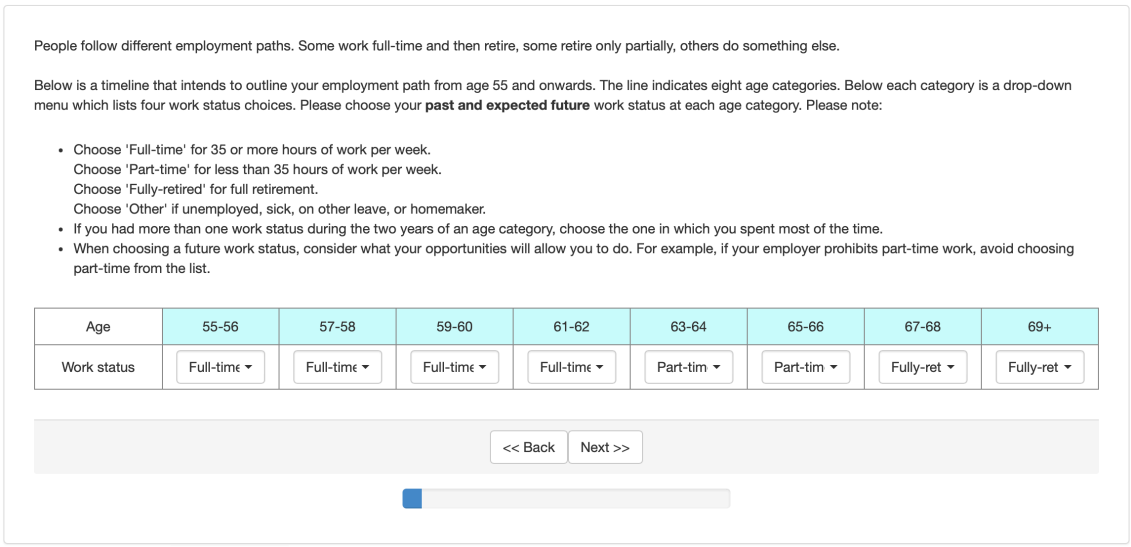

Figure 15: Question asking to outline past and expected future work status from age 55 onwards.

Table 8: Most common self-reported retirement sequences

Sequence	Percent	Sequence	Percent
22222333	6.68	11111111	1.04
22222233	6.30	13333333	1.04
44444444	5.35	11223333	0.98
11111133	4.35	22333333	0.91
44444333	3.97	11123333	0.88
11111333	3.87	11111122	0.85
22223333	3.75	11122223	0.82
22233333	3.75	11222233	0.72
11113333	3.65	23333333	0.72
11133333	2.83	11111222	0.66
33333333	2.68	11112223	0.66
11122333	2.61	11111112	0.63
11112233	2.52	11144333	0.63
44444433	2.49	11444333	0.63
22222223	2.24	12223333	0.60
11111233	2.08	12222333	0.57
11122233	1.95	22244333	0.57
11112333	1.89	22444333	0.50
11111113	1.67	11233333	0.41
11111123	1.48	12233333	0.41
11333333	1.35	12222233	0.35
11111223	1.32	22224333	0.35
22222222	1.32	44444443	0.35
11222333	1.10	11114333	0.31

Notes: 1. 1: Full-time work, 2: Part-time work, 3: Retired; 4: Other. 2. Retirement sequences are ranked according to the percentage of 3,176 respondents who reported the sequence. 3. The eight elements of a given sequence refer to the self-reported work status at eight age categories given by 55-56, 57-58, 59-60, 61-62, 63-64, 65-66, 67-68, and 69 plus.

Table 9: Model fit

Retirement age regime	Type of retirement	Full or partial retirement age	Percent of choices in the survey	Percent of choices predicted by the model
61	E	61	19.05	19.82
	P	61-65	37.70	33.37
	L	66	43.24	46.79
63	E	63	25.95	29.97
	P	63-67	43.08	34.95
	L	68	30.96	35.07
65	E	65	41.23	40.96
	P	65-69	40.45	36.66
	L	70	18.31	22.36

Note: E: Early retirement. P: Partial retirement. L: Late retirement.